WHAT IS CLAIMED IS:

1. An *in vivo* method for characterizing tissue in a blood vessel wall, the method comprising

(a) illuminating a tissue in the blood vessel wall with any two or more single wavelengths or one or more narrow wavelength bands of near-infrared radiation within a wavelength range of about 1100 to 1415 nm;

(b) detecting radiation reflected from the tissue having a wavelength of from about 1100 to 1415 nm;

(c) processing the detected radiation to characterize the tissue in the blood vessel wall; and

(d) providing an output indicating the tissue characterization.

2. The method of claim 1, wherein the one or more narrow wavelength bands each span about 1.0 nm to about 100 nm within the wavelength range of 1100 to 1415 nm.

3. The method of claim 1, wherein two single wavelengths are used.

4. The method of claim 1, wherein two narrow wavelength bands, each spanning 1.0 nm to 30 nm within the wavelength range of 1100 to 1415 nm are used.

5. The method of claim 1, wherein at least one narrow wavelength band and at least one single wavelength are used.

6. The method of claim 1, wherein the wavelength range is about 1100 to 1350 nm.

7. The method of claim 1, wherein the wavelength range is about 1150 to 1250 nm.

8. The method of claim 1, wherein the wavelength range is about 1175 to 1280 nm.

9. The method of claim 1, wherein the wavelength range is about 1190 to 1250 nm.

10. The method of claim 1, further comprising illuminating the tissue in the blood vessel wall with any two or more single wavelengths or one or more narrow wavelength bands of near-infrared radiation within a second wavelength range of about 1600 nm to 1780 nm; and further detecting radiation reflected from the tissue having a second wavelength of from about 1600 nm to 1780 nm.

11. The method of claim 10, wherein the second wavelength range is about 1650 to 1730 nm.

12. The method of claim 1, wherein the blood vessel is filled with blood, and the tissue in the blood vessel wall is illuminated through the blood, and reflected radiation is detected through the blood.

13. The method of claim 12, wherein the blood in the blood vessel is occluded.

14. The method of claim 13, wherein the blood is occluded by a balloon.

15. The method of claim 1, wherein the blood vessel is filled with a biocompatible liquid, and the tissue in the blood vessel wall is illuminated through the biocompatible liquid, and reflected radiation is detected through the biocompatible liquid.

16. The method of claim 1, wherein the processing comprises the use of qualitative chemometric discrimination algorithms.

17. The method of claim 16, wherein the algorithms utilize partial least squares-discriminate analysis (PLS-DA), principle component analysis with Mahalanobis Distance (PCA-MD), or principle component analysis with Mahalanobis Distance and augmented residuals (PCA/MDR).

18. The method of claim 16, wherein the processing comprises classifying the detected radiation into two or more categories.

19. The method of claim 1, wherein the processing comprises the use of quantitative chemometric algorithms.

20. The method of claim 19, wherein the algorithms utilize partial least squares (PLS) or principal component analysis (PCA).

21. The method of claim 1, further comprising preprocessing the detected radiation to remove spectral information not related to a characterization of the tissue.

22. The method of claim 1, wherein the blood vessel is an artery.

23. The method of claim 1, wherein the blood vessel is a coronary artery.

24. The method of claim 1, wherein the tissue comprises a lipid pool.

25. The method of claim 1, wherein the tissue comprises a lipid pool and a thin fibrous cap.

26. The method of claim 1, wherein the tissue comprises a lipid pool and a thick fibrous cap.

27. The method of claim 1, wherein the tissue comprises fibrotic or calcific tissue.

28. The method of claim 1, wherein the output provides a continuous grading of the scanned tissue.

29. The method of claim 1, wherein the output categorizes the scanned tissue into two, three, or more different categories of lesions.

30. The method of claim 1, wherein the output categorizes the scanned tissue as either healthy or a vulnerable plaque.

31. The method of claim 1, wherein the output is a graphical representation of the signals corresponding to the reflectance spectra.

32. The method of claim 1, wherein the output is a color scheme of the tissue characterization.

33. The method of claim 1, wherein the processing comprises applying a threshold to determine whether the scanned tissue is diseased or not.

34. The method of claim 33, wherein the processing comprises applying a threshold determined by optimizing the separation between two or more groups to establish a boundary calculation that determines whether the scanned tissue is diseased or not.

35. The method of claim 33, wherein the output categorizes the tissue as lipid-rich or not.

36. The method of claim 1, wherein the output categorizes the tissue as lipid-rich, calcific, fibrotic, normal, or other.

37. The method of claim 33, wherein the output categorizes the tissue as TCFA or not.

38. The method of claim 33, wherein the output categorizes the tissue as a vulnerable lesion or not.

39. The method of claim 1, wherein the output categorizes the tissue as diseased or not without applying a threshold.

40. An apparatus for scanning and characterizing tissue in vivo, comprising:

a near-infrared radiation source that generates radiation comprising any two or more single wavelengths or one or more narrow wavelength bands of near-infrared radiation within a wavelength range of about 1100 to 1415 nm;

one or more radiation conduits for transmitting radiation from the radiation source to the tissue and for receiving radiation not absorbed by the tissue;

a radiation detector that collects radiation not absorbed by the tissue across a wavelength range of substantially 1100 to 1415 nm;

a processor that processes the collected radiation to characterize the tissue; and

an output device that indicates the characterization of the tissue.

41. The apparatus of claim 40, wherein the near-infrared radiation source generates a wavelength range of about 1100 to 1350 nm.

42. The apparatus of claim 40, wherein the near-infrared radiation source generates two narrow wavelength bands, each spanning 1.0 nm to 30 nm within the wavelength range of 1100 to 1415 nm.

43. The apparatus of claim 40, wherein the near-infrared radiation source generates a wavelength range of about 1150 to 1250 nm.

44. The apparatus of claim 40, further comprising a near-infrared radiation source that generates radiation comprising any two or more single wavelengths or one or more narrow wavelength bands of near-infrared radiation within a second wavelength range of about 1600 to 1780 nm.

45. The apparatus of claim 40, wherein the output device provides a graphical representation of the radiation diffusely reflected from the scanned tissue.

46. The apparatus of claim 40, wherein the output device provides a functional color scheme of the scanned tissue.

47. The apparatus of claim 40, wherein the output device provides a continuous grading of the scanned tissue.

48. The apparatus of claim 40, wherein the processor and output device categorize the scanned tissue into two, three, or more different categories of lesions.

49. The apparatus of claim 40, wherein the processor and output device categorize the scanned tissue as either healthy or a vulnerable plaque.

50. The apparatus of claim 40, wherein the processor applies a threshold to determine whether the scanned tissue is diseased or not.

51. The apparatus of claim 40, wherein the processor applies a threshold determined by minimizing a classification between two or more groups to establish a boundary calculation that determines whether the scanned tissue is diseased or not.

52. The apparatus of claim 40, wherein the output device comprises a screen that shows basic patient information, the date and time of a scan, a digitized longitudinal view of a scanned tissue, and a digitized cross-section of a particular section of scanned tissue.

53. The apparatus of claim 40, wherein the digitized longitudinal view and cross-sections of the scanned tissue are separated into sections, and wherein each section indicates that the point of tissue represented by that section is either healthy or diseased.

54. The apparatus of claim 40, wherein the digitized longitudinal view and cross-sections of the scanned tissue are separated into sections, and wherein each section indicates one of a continuous grade of a plurality of colors representing the health of the tissue at that point.

55. The apparatus of claim 40, wherein the digitized longitudinal view and cross-sections of the scanned tissue are separated into sections, and wherein each section indicates one of a continuous grade of shades of gray representing the health of the tissue at that point.

56. The apparatus of claim 40, wherein the processor and output device provide constituent concentrations of the scanned tissue.

57. An instrument for characterizing portions of tissue *in vivo*, the instrument comprising

a) means for illuminating portions of tissue with near-infrared radiation comprising any two or more single wavelengths or one or more narrow wavelength bands of near-infrared radiation within a wavelength range of about 1100 to 1415 nm;

b) means for collecting radiation within the wavelength range that is not absorbed by the tissue;

c) means for determining from the collected radiation the amounts of absorbance of radiation by the illuminated tissue; and

d) means for discriminating one illuminated tissue component from another illuminated tissue component within the wavelength range, wherein the discriminating means comprises

i) means for preprocessing the absorbance amounts using a chemometric preprocessing technique, and

ii) means for performing a chemometric discrimination algorithm on the preprocessed absorbance amounts to characterize the tissues; and

e) means for providing an output indicating the characterization of the illuminated tissue.

58. A method of analyzing tissue in blood vessel walls *in vivo* utilizing a fiber optic probe, the method comprising:

introducing the probe into a blood vessel;

directing onto the tissue in the blood vessel wall near-infrared radiation comprising any two or more single wavelengths or one or more narrow wavelength bands within a wavelength range of about 1100 to 1415 nm;

detecting radiation, within a wavelength range from substantially 1100 to 1415 nm, which is not absorbed by the blood vessel wall; and

analyzing the detected radiation to categorize the tissue in the blood vessel wall.

59. A method of displaying spectral data corresponding to a tissue, the method comprising

(a) scanning a series of points within the tissue with radiation;

(b) detecting radiation reflected from the tissue;

(c) processing the detected radiation to generate a set of numbers wherein each number in the set characterizes a different point of scanned tissue; and

(d) converting the set of numbers into a continuous grade output that characterizes the tissue without a threshold.

60. The method of claim 59, wherein the continuous grading is represented by a false color scale.

61. The method of claim 59, wherein the continuous grading is represented by a gray scale or different tones, pitches, or volumes of sound.

62. The method of claim 59, wherein the radiation is near-infrared radiation.

63. The method of claim 59, wherein the tissue is characterized by the constituent concentrations within the scanned tissue.